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SPACEFLIGHT AND DEVELOPMENT OF IMMUNE RESPONSES

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INTRODUCTION

Evidence from both human and rodent studies has indicated that alterations in immunological parameters occur after space flight [1]. The number of flight experiments has been small, and the full breadth of immunological alterations occurring after space flight remains to be established. Among the major effects on immune responses after space flight that have been reported are: alterations in lymphocyte blastogenesis and natural killer cell activity [1-3], alterations in production of cytokines [4,5], changes in leukocyte sub-population distribution [6], and decreases in the ability of bone marrow cells to respond to colony stimulating factors [6]. Changes have been reported in immunological parameters of both humans and rodents [1]. The significance of these alterations in relation to resistance to infection remains to be established.

The objective of the studies contained in this project is to determine the effects of space flight on immune responses of pregnant rats and their offspring. The hypothesis is that space flight and the attendant period of microgravity will result in alteration of immunological parameters of both the pregnant rats as well as their offspring carried *in utero* during the flight. The parameters to be tested include: production of cytokines, composition of leukocyte sub-populations, response of bone marrow/liver cells to granulocyte/monocyte colony stimulating factor, and leukocyte blastogenesis. Changes in immune responses that could yield alterations in resistance to infection may be determined. The duration of alterations in immune responses may also be determined. This could yield useful information for planning studies that could contribute to crew health. Additional information useful to determine the potential for establishment of a permanent colony in space could be obtained.

METHODS

The methods used in the study involved the determination of leukocyte sub-populations and the production of cytokines. Tissue samples were obtained from both the parental dams and the fetuses/pups. The tissue were obtained from the flight animals after flight, as well as from ground control animals. For the leukocyte sub-population analysis, whole blood was taken using heparin as the anticoagulant or spleen cells were harvested. Samples of whole blood or bone marrow cells were stained with monoclonal antibodies directed against cell surface antigens. Cells will then analyzed for fluorescence using a Facstar flow cytometer [7].

The spleen and thymus tissues were treated with either phytohemagglutinin-P/concanavalin-A or polyribosinic-polyribocytidylic acid. After the appropriate incubation period at 37°C, the culture supernatant fluids were harvested and stored at -70°C [8]. The supernatant fluids were assayed by ELISA assays for interferon-alpha and -gamma production as well as interleukin production [8].

The ability of bone marrow cells (from dams) or liver cells (from fetuses/pups) to respond to exogenous granulocyte/monocyte colony stimulating factor was determined by placing the cells in methylcellulose with medium and waiting one week for the development of colonies of 50 cells or more.

RESULTS AND DISCUSSION

In the second six months of this grant period, we carried out the flight experiments. Tissues were obtained from flight and control dams, fetuses, and pups. All tissues were obtained successfully, and were shipped successfully to the laboratory at the Carolinas Medical Center.

Among the tissues obtained were spleen, liver, thymus, bone marrow, and blood. The tissues were cultured sterilely. The immunological assays required, including flow cytometry, colony stimulating factor responses and cytokine production were carried out successfully. An additional hormone assay on blood was also carried out, as well an hematocrit evaluation and CBC.

The data are currently being analyzed. Results should be available in the near future.

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